CLAIMS

1.   A method of global motion estimation between frames of a motion-compensated inter-frame encoded video sequence, each frame of the sequence having a plurality of
5   motion vectors encoded therein relating the frame to a preceding and/or succeeding frame of the sequence; the method comprising, for a particular inter-frame encoded frame:

      a) decoding the motion vectors of the frame;

      b) selecting N sets of the motion vectors, wherein N is an integer value greater
10   than 1;

      c) calculating a motion estimation for each set;

      d) calculating a median squared error value for each motion estimation; and

      e) selecting the motion estimation with the least median squared error value as that representative of the global motion of the frame with respect to a preceding or
15   succeeding anchor frame.

2.   A method according to claim 1, and further comprising the step of excluding certain motion vectors with predetermined characteristics from being selected as a member of one of the N sets.
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3.   A method according to claim 2, wherein the excluded motion vectors include those motion vectors from one or more areas substantially around the boundary of the frame.

25   4.   A method according to claims 2 or 3, wherein the excluded motion vectors include those motion vectors whose value is substantially zero.

5.   A method according to any of the preceding claims, wherein the selecting step b) further comprises randomly selecting s motion vectors from the available motion vectors
30   for each of the N sets, wherein s is the minimum number for sufficiently estimating a geometrical transformation.

6.   A method according to any of the preceding claims, and further comprising the steps of:

      c) testing the selected motion estimation representative of the global motion; and

d) outputting the selected motion estimation as being representative of the global motion of the frame if the test is passed.

7. A method according to claim 6, wherein the test comprises comparing the selected motion estimation with a threshold value, wherein the test is passed if the parameters do not exceed the threshold value.

8. A method according to claims 6 or 7, wherein if the test is failed, the method further comprises:

e) determining a motion estimation representative of the global motion of the frame with respect to a preceding or succeeding other frame;

f) determining a motion estimation representative of the global motion of the other frame with respect to the anchor frame; and

g) accumulating the motion estimations to give an overall motion estimation substantially representative of the global motion of the frame with respect to the anchor frame.

9. A method according to claim 8, wherein the determining steps e) and f) each comprise a method substantially in accordance with any of the preceding claims.

10. A method according to any of claims 6 to 9, wherein if the test is failed, the method further comprises:

interpolating between the motion estimations of adjacent frames to give an interpolated motion estimation which is then output as the motion estimation representative of the global motion of the frame.

11. A method of generating panoramic images from a motion-compensated inter-frame encoded video sequence, the method comprising:

for each frame of the sequence, determining the global motion of each frame with respect to its anchor frame using the method of any of the preceding claims; and

generating at least one panoramic image representing the frames of the video sequence using the global motion estimations thus determined..

12. A method according to claim 11, wherein the generating step further comprises:

selecting a particular frame of the sequence as a reference frame, the plane of the reference frame being a reference plane;

for each frame other than the reference frame, accumulating the global motion estimations from each frame back to the reference frame;

5   warping each frame other than the reference frame onto the reference plane using the accumulated global motion estimations to give one or more pixel values for each pixel position in the reference plane; and

for each pixel position in the reference plane, selecting one of the available pixel values for use as the pixel value in the panoramic image.

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13.   A method according to claim 12, wherein the selecting step comprises selecting a substantially median pixel value from the available pixel values for use in a background panoramic image.

15   14.   A method according to claims 12 or 13, wherein the selecting step comprises selecting a substantially most different pixel value from the available pixel values for use in a foreground panoramic image.

15.   A method according to any of claims 12 to 14, wherein the selecting step
20   comprises:

calculating the mean pixel value of the available pixel values;

calculating the L1 distance between each available pixel value and the calculated mean pixel value; and

select the pixel value with the median L1 distance for use in a background
25   panoramic image.

16.   A method according to any of claims 12 to 15, wherein the selecting step comprises:

calculating the mean pixel value of the available pixel values;

30   calculating the L1 distance between each available pixel value and the calculated mean pixel value; and

select the pixel value with the maximum L1 distance for use in a foreground panoramic image.

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17.   A system for global motion estimation between frames of a motion-compensated inter-frame encoded video sequence, each frame of the sequence having a plurality of motion vectors encoded therein relating the frame to a preceding and/or succeeding frame of the sequence; the system comprising:

5   a) a video decoder arranged in use to decode the motion vectors of each inter-frame encoded frame; and

           b) a video processing means arranged in use to:

               i) select N sets of the motion vectors, wherein N is an integer value greater than 1;

10   ii) calculate a motion estimation for each set;

               iii) calculate a median squared error value for each motion estimation; and

               iv) select the motion estimation with the least median squared error value as that representative of the global motion of the frame with respect to a preceding or succeeding anchor frame.

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18.   A system according to claim 17, wherein the video processing means further comprises motion vector exclusion means for excluding certain motion vectors with predetermined characteristics from being selected as a member of one of the N sets.

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19.   A system according to claim 18, wherein the excluded motion vectors include those motion vectors from one or more areas substantially around the boundary of the frame.

25 20.   A system according to claims 18 or 19, wherein the excluded motion vectors include those motion vectors whose value is substantially zero.

21.   A system according to any of claims 17 to 20, wherein the video processing means is further arranged in use to:

30   randomly select s motion vectors from the available motion vectors for each of the N sets, wherein s is the minimum number for sufficiently estimating a geometrical transformation.

22.   A system according to any of claims 17 to 21, and further comprising:

c) estimation testing means arranged in use to test the motion estimation selected as being representative of the global motion; and

d) output means for outputting the motion estimation selected as being representative of the global motion of the frame if the test is passed.

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23.   A system according to claim 22, wherein the estimation testing means is further arranged to compare the motion estimation with a threshold value, wherein the test is passed if the motion estimation does not exceed the threshold value.

10 24.   A system according to claims 22 or 23, wherein if the estimation testing means determines that the test is failed, the video processing means is further arranged to:

v) determine a motion estimation representative of the global motion of the frame with respect to a preceding or succeeding other frame;

vi) determine a motion estimation representative of the global motion of the other
15 frame with respect to the anchor frame; and

vii) accumulate the motion estimations to give an overall motion estimation substantially representative of the global motion of the frame with respect to the anchor frame.

20 25.   A system according to any of claims 22 to 24, and further comprising:

estimation interpolation means arranged to interpolate between the motion estimations of adjacent frames to give an interpolated motion estimation which is then output as the motion estimation representative of the global motion of the frame.

25 26.   A system for generating panoramic images from a motion-compensated inter-frame encoded video sequence, comprising:

a system for global motion estimation between frames of a motion-compensated inter-frame encoded video sequence as claimed in any of claims 17 to 25, and further arranged to provide global motion estimations for each frame; and

30   panoramic image generating means for generating at least one panoramic image representing the frames of the video sequence using the global motion estimations thus determined.

27.   A system according to claim 26, wherein the panoramic image generating means
35 is further arranged in use to:

select a particular frame of the sequence as a reference frame, the plane of the reference frame thereby being a reference plane;

for each frame other than the reference frame, accumulate the global motion estimations from each frame back to the reference frame;

5   warp each frame other than the reference frame onto the reference plane using the accumulated global motion estimations to give one or more pixel values for each pixel in the reference plane; and

for each pixel position in the reference plane, select one of the available pixel values for use as the pixel value in the panoramic image.

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28.   A system according to claim 27, wherein the panoramic image generating means is further arranged to select a substantially median pixel value from the available pixel values for use in a background panoramic image.

15   29.   A system according to claims 26 or 27, wherein the panoramic image generating means is further arranged to select a substantially most different pixel value from the available pixel values for use in a foreground panoramic image.

20   30.   A system according to any of claims 27 to 29, wherein the panoramic image generating means is further arranged to:

calculate the mean pixel value of the available pixel values;

calculate the L1 distance between each available pixel value and the calculated mean pixel value; and

select the pixel value with the median L1 distance for use in a background
25   panoramic image.

31.   A system according to any of claims 27 to 30, wherein the panoramic image generating means is further arranged to:

calculate the mean pixel value of the available pixel values;

30   calculate the L1 distance between each available pixel value and the calculated mean pixel value; and

select the pixel value with the maximum L1 distance for use in a foreground panoramic image.

32.   A computer program or suite of programs arranged such that when executed on a computer system the program or suite of programs causes the computer system to perform the method of any one of the preceding claims.

5   33.   A computer readable storage medium storing a computer program or suite of programs according to claim 32.